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"Gheorghe Asachi" Technical University of Iasi, Romania

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COMPARATIVE GROWTH STUDIES OF THE HYPERTHERMOPHILIC *ARCHAEON SULFOLOBUS SOLFATARICUS P2* ON SULFUR COMPOUNDS FOUND IN FOSSIL FUELS

Gokhan Gun[1], Yuda Yurum[2], Gizem Dinler[1]

[1]*Istanbul Technical University, Molecular Biology and Genetics Department, Istanbul, Turkey;* [2]*Sabanci University, Faculty of Engineering and Natural Sciences, Istanbul Turkey*

Abstract

All fossil fuels contain at least 200 kinds of organic sulfur compounds (benzothiophene, dibenzothiophene, their derivatives and variety of complex molecules) and inorganic sulfur compounds. To remove the sulfur compounds from petroleum or coal, hydrodesulfurization (HDS) carried out with chemical catalysts is not effective to completely remove heterocyclic organosulfur compounds such as dibenzothiophene (DBT), benzothiophene (BT) and their derivatives. Biodesulfurization, the use of microorganisms and/or enzymes for lowering the sulfur content of petroleum products, is an alternative process to HDS. It requires relatively low temperature and pressure. The process is also contributes both organic and inorganic sulfur removal in fossil fuels.

In our study, an aerobic thermoacidophilic archaeon *Sulfolobus solfataricus* P2 that grows optimally at 80°C and pH 3.0 was used for biodesulfurization of organosulfur compounds. First, a sulfur free mineral (SFM) medium was developed and supplemented with various carbon sources containing arabinose, ethanol, glucose, mannose and mannitol to a final concentration of 0,2% w/v to find the most suitable carbon source for optimal archeal growth. After determining glucose as a carbon source in our SFM medium, we found the most effective glucose concentrations 2% w/v. Later, the ability of the S. solfataricus to grow on organic and inorganic sulfur sources such as DBT, dibenzothiophene sulfone, BT, 4,6-dimethyldibenzothiophene, sodium sulfite, sodium sulfate, potassium disulfite, and potassium persulfate was investigated under SFM and yeast-supplemented mineral medium (Brock's medium). Addition of organic sulfur sources, such as 0,3 mM of dibenzothiophene sulfone, 4,6-dimethyldibenzothiophene and BT, to SFM after reaching to a moderate optical density (OD600nm=~0,4) caused an increase on the growth rate but DBT at this concentration ceased the S. solfataricus growth. Further investigations revealed the maximum DBT tolerance of S. solfataricus as 0,1 mM. We also investigated the growth behavior of S. solfataricus when inorganic sulfur compounds were supplemented both to SFM and yeast-supplemented media. We showed that 0,3 mM of sodium sulfite, sodium sulfate, potassium disulfite, and potassium persulfate caused a significant increase in the growth rate of S. solfataricus. Current studies are underway to determine the consumption rates of DBT and BT by S. solfataricus in a minimal and enriched growth media. The results of this work will enable us to determine the optimal growth and biodesulfurization conditions while studying coal samples.

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